

OUR BOOK SHELF.

Plane Trigonometry for the Use of Colleges and Schools. With numerous Examples. By I. Todhunter, F.R.S. Revised by R. W. Hogg. (London: Macmillan and Co., 1891.)

TODHUNTER'S "Trigonometry" is a very familiar friend of ours, and we have now before us a bundle of letters which we received from the author in 1861 and 1862, in reply to our criticisms and corrections of the early editions. The first edition swarmed with small *errata*, for the pointing out of which we received warm thanks. It was a good book for some years, on account of the excellent collection of problems, but of late it sadly wanted bringing up to date. Mr. Hogg has done his work well, but possibly he would have produced a better independent book. The first 200 pages have undergone very little change, and we have only noted here and there an interpolated article. Chapter xviii., "Miscellaneous Propositions," contains several novelties (as contrasted with the last edition we have of the original work), such as geometrical proofs of familiar formulæ and graphs of the trigonometrical functions. There are numerous important additions in chapters xxi.-xxiv., which bring this part of the work more *en rapport* with present day requirements, notably Schlömilch's resolution of $\sin \theta$ into factors, and a too brief account of hyperbolic functions. The prime feature is the addition of a very great number of excellent recent exercises in all parts of the subject. The work forms a good school-book, and will meet the requirements of a large number of students.

Lessons in Astronomy. By C. A. Young, Ph.D., LL.D. (Boston, U.S.A., and London: Ginn and Co., 1891.)

THIS is the third of a series of text-books recently prepared by Prof. Young for use in schools and colleges of different grades. The two previous ones have already been noticed in NATURE (vol. xxxix p. 386, and vol. xli. p. 485). The present work is described on the title page as "a brief introductory course without mathematics, for use in schools and seminaries." The three books have much in common, and each one has many good points. We cannot help feeling, however, that the steps between them are too small. Almost exactly the same ground is covered by each, and they differ chiefly in the amount of previous knowledge assumed. But the acquaintance with mathematics required for a thorough comprehension of the "General Astronomy" is by no means great, and even for the "Lessons" a certain knowledge of geometrical principles is essential. If we must needs have three books, the "General Astronomy" contains too little, and the "Lessons"—a book of some 350 pages—contains too much.

The chief variation calling for notice is in the portion dealing with uranography. This now forms chapter ii., and, with the aid of the maps, forms a fairly complete and easy guide to the constellations. The notes on the legendary mythology of the constellations, which have been added for the benefit of students not acquainted with classical literature, gives this chapter an additional interest.

The book is brought well up to date, and is a model of good printing.

Cosmical Evolution: a New Theory of the Mechanism of Nature. By Evan McLennan. (Chicago: Donohue, Henneberry, and Co., 1890.)

THE author states that the essential principle of the new theory is "that every known heavenly body is connected with its neighbouring heavenly bodies by means of real, material bonds, and that every phenomenon of the universe, without exception, is due solely to the action of bodies upon one another through, and by means of, these bonds which join them together" (p. 48).

Among the principal evidences in favour of the existence of this material planetary connection is that "we actually see them with the naked eye" in the zodiacal light and in the streamers of the solar corona.

The theory is of a very general nature, and includes not only cosmical but terrestrial phenomena, such as ærial and aqueous tides, terrestrial electricity and magnetism. The author is of opinion that "the greater tidal wave is due to the sun, and the lesser to the moon" (p. 291).

The conditions of prelunar and other races of mankind are also discussed (p. 360). The work consists of 399 pages. There is no index.

The Telescope: an Introduction to the Study of the Heavens. By J. W. Williams. (London: Swan Sonnenschein and Co., 1891.)

THE writer of this book is author of "British Fossils, and where to Seek Them," and "Land and Water Shells, &c." In his preface he quotes with approval the adage, "Ground your knowledge of any special group on a general knowledge of nature as a whole." This is perhaps why he now turns his attention from shells to astronomy. However this may be, the work has been carefully compiled, and is to be recommended as a safe guide. Some of the illustrations are excellent.

LETTERS TO THE EDITOR.

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Silver Lodes and Salt Lakes.

SINCE the discovery, some five or six years ago, of the extraordinary Broken Hill lode of silver-bearing ores, the public excitement on the subject in this part of the world has been attended with comparatively little scientific interest in regard to the geological features of the argentiferous country and the probable origin of deposits so vast and so remarkable in character; yet I believe that an examination of the main topographical and geological features of the eastern parts of South Australia and the western parts of New South Wales will probably throw more light upon the interesting subject of the origin of argentiferous lodes than the study of any other now known part of the globe; and, as I have had an opportunity of going closely into the matter during a recent visit to Broken Hill, I propose to lay briefly before your readers a few facts which seem to afford presumptive evidence in favour of the supposition that salt lakes and silver lodes are causally connected.

An examination of the ores *in situ* at Broken Hill, and especially in the portions of the lode which are known as blocks 10 and 11, reveals the fact that stratification almost exactly similar to that of an ordinary alluvial deposit is practically universal throughout the lode. So obvious has this been from the very beginning of the working, that almost every mining man who has had anything to do with Broken Hill has remarked upon the very obvious fact that the ores are to be ascribed to an aqueous origin. The fissure in which the lode occurs varies from a few feet to seventy or eighty yards in width, and has almost vertical walls. Within these boundaries the stratified deposits of carbonates and chlorides are intermingled with immense bodies of kaolin and sulphides, with a considerable amount of an interesting silicate of zinc also carrying silver and lead. The Barrier District is one of the driest in the whole of this very dry continent, and there is no river within about seventy or eighty miles. The few intermittent watercourses which exist in the locality do not suggest anything but a dry and arid climate. In fact, the greatest difficulty now met by the mines and by the town of Broken Hill, which contains about 27,000 inhabitants, is the scarcity of water, and the doubtful nature of any catching grounds that have been suggested. If, therefore, water was the agency by which the deposits of

ore took place, it is evident that the conditions at the time must have been very different from what they are at present.

The key to the whole situation seems to lie in the fact, which has been so well pointed out by Mr. Alfred Russel Wallace and others, that the whole of the regions of Central Australia have emerged from the ocean at a period which, from a geological point of view, is comparatively recent. The axial lines of the watershed ranges appear to be rising at a more rapid rate than the neighbouring plains, and consequently some strange and interesting changes are taking place in the relations of the catchment areas of flood waters and their outlets. In the locality of Innamincka, almost due north from Broken Hill, there occurs a phenomenon which is obviously due to some such change of relations. The Strezlecki Creek runs to the south-west from Innamincka. Its bed holds immense deposits of drift-sand, and in the adjoining plains are to be seen many curious parallel ridges of sand-hills, all strongly suggestive of the action of drift water, such as at times passes across the surface of these vast interior plains at flood time. The Strezlecki Creek was apparently the outlet for most if not all of the water of Cooper's Creek at some period of time not at all remote. But at the present day it is only once in every four or five years that the stream runs at all. When a very high flood fills the bed of the Cooper to overflowing, the waters find their way over the low ridge of land which separates the present bed of the Cooper from that of the Strezlecki, and so on to Lakes Blanche and Gregory—those large salt evaporation pans which can scarcely with propriety be dignified with the name of lakes. The gradual elevation of the low ridge would appear to be the most probable explanation of this interesting phenomenon. Now, to the south of Broken Hill, and in the vicinity of the River Darling, there is to be found ample evidence of a somewhat similar occurrence. Vast accumulations of sand in parallel ridges are still to be seen crossing the plains, and a large river bed extends, from a place quite close to the junction of the Darling and Murray, northwards in the direction of Broken Hill. Whether this "Anabbranch," as it is called, is really an old bed of the River Darling or not, I will not stay to inquire. It would, however, appear practically certain that some slight alteration in the level of the land has been responsible for the change in the direction of the flow of water.

The case is not an ordinary one of the diversion of a river owing to the accumulation of its own alluvium; and the sand ridges, which in places extend right down to the bed of the present river, suggest the action of water on a scale of magnitude very different from that which is at present to be seen. Here, then, we have both to the north and to the south of Broken Hill evidences of the existence in former times of floods of water, which at the present day are never at all to be seen on the southern side, and only once in every four or five years on the northern side. It is to be observed that both of these localities are within the line of country formed by the parallel mountain systems of the Flinders Range on one side and the Grey and Barrier Ranges on the other side. Between these two ridges the land slopes gradually to the west, and three salt lakes, of which the largest is Lake Frome, attest the fact that in all probability at one time vast quantities of sea-water were imprisoned by the rising of the land from the level of the ocean. But in South Australia these two ridges are joined by a band of high land, on which the present railway to Broken Hill has been laid. This band of country forms, along with the ranges at each side, a sort of *cul de sac*, from which at present the waters could have no escape to the southwards unless they rose to a higher level than is ever noticeable under existing conditions.

But this has not been the case in times gone by. The evidences of the action of water in the neighbourhood of the "Anabbranch" make it to appear practically certain that at one time the flood waters, which swept through the salt lakes, must have poured over the ridge towards the River Darling, and found an outlet by that means. This, then, brings me to the most significant fact to which I wish to direct attention. The locality of Broken Hill is the lowest point in the axis of the line of country which forms what I have alluded to as the *cul de sac*. In the absence of any survey from which full data could be deduced, it is sufficient to take the levels of all the railway stations from the Flinders Range to Tarrawingie—a point forty-two miles north-east of Broken Hill. These show that the railway (which happens to follow the line of the ridge) dips gradually to Broken Hill, and then rises again towards Tarrawingie. The conclusion is therefore inevitable, from the data

to which I have already referred, that Broken Hill is the locality at which the accumulations of flood-water from the great region of the salt lakes must have found their way across the connecting ridge and on towards the River Darling. I believe, if the localities of the silver lodes of Potosi and Comstock are examined, they will be found to bear somewhat the same relation to the extensive salt marshes south of Lake Titicaca, and to the salt, mud, and alkaline lakes respectively, that Broken Hill does to Lakes Frome, Blanche, and Gregory; but, in the case of the last-named, the time at which the action took place is apparently much more recent, and the evidences which it has left are, therefore, all the more evident. It is a significant fact that the whole of the horseshoe-shaped line of country, of which, as I have said, Broken Hill is the lowest point, is highly mineralized, and contains mines for gold, silver, copper, and lead; but of all these mines, the Broken Hill lode is really an epitome, containing, as it does, nearly every metal which is known to the practical miner, and some also of those which are more of scientific than of practical interest. In view of the existence, among other things, of large lateral shoots from this gigantic lode containing the largest specimens of native silver yet discovered in any part of the globe, it seems difficult to account for some of the phenomena present at Broken Hill without premising the agency of electro-deposition. Several of the arguments which were adduced by me in NATURE of March 20, 1890, in regard to the occurrence of gold, would appear to furnish equally strong presumptive evidence that earth-currents acting along the axis of the range have had something to do with the deposition of metals from their solutions during their passage across the ridge. My present purpose, however, goes no further than to call attention to the probable origin of the lode, which I believe is to be found in the minerals held in solution in the waters of some of the vast Australian lakes and evaporation pans.

GEORGE SUTHERLAND.

Adelaide, South Australia.

A Magnificent Meteor.

AT 1.15 a.m., on July 31, I observed a most magnificent meteor—a veritable Andromedas. It was much larger than Jupiter, which was on my right, in the constellation Pisces, shining to the best advantage on a dark blue sky. After the retina of my eye got clear of the dazzling light of the meteor, I turned to Jupiter, which was in a favourable condition for comparison, the clouds being opportunely absent, but it looked at least three times smaller than the meteor, which, indeed, was entitled to be called a fire-ball. It illuminated the whole district with the brilliancy of the noonday sun. I traced it back through Mira Ceti, and to the right of Mesartum Arietis, into the direction of λ Andromedæ. This magnificent meteor exploded near the earth, without any detonation. The light was perfectly white. There was a very peculiar feature in the apparition of this meteor: it appeared to be very near to me, and between its body and the horizon behind it there seemed to be a vast distance. In its explosion it assumed very large dimensions, and the effulgence lasted for three seconds with undiminished splendour. In reality there were two explosions. The trail of light was dim, except immediately behind, where it was thick and bright, but of short duration.

On the night of July 31, and on the morning of August 1, there was a brilliant display of stars for this time of the year; the Milky Way was well defined from horizon to horizon, denoting a certain degree of frost. At present, Jupiter is the most conspicuous and most brilliant ornament in the nocturnal heavens; here in Scotland its glory is enhanced by the somewhat frosty nights which occasionally visit us about this season.

DONALD CAMERON.

Paisley, August 3.

Bees and Honey-dew.

NEAR here is an avenue of alternate beech and oak trees, and, in walking through it, my attention has lately been drawn to a loud humming in the beeches, similar to that heard in lime trees when in flower, while the oaks are silent. The sound is, I find, produced from bees in search of the Aphis secretions on the leaves of the beeches, the under sides of which are sticky with the substance. The bees appear to be all of one type—a small size of the large humble-bee—with a white tail. They never settle on the under sides of the leaves direct, but just on the margins.